

SIZE AND ASSORTATIVE MATING IN THE SHORE CRAB, *CARCINUS MAENAS*

Mating in the common shore crab, *Carcinus maenas*, can only occur when the female has recently moulted. Males find females about to moult by free search, and guard them until they moult. When mating occurs, they will subsequently guard the female until her new carapace hardens. Males will compete aggressively over receptive females, and it is generally assumed that the larger, stronger males will be able to mate with the largest, and presumably, most fecund females. This would be expected to result in a homogamous mating pattern, which we, and others have observed in this species. This type of mating pattern is also seen in other brachyuran species.

The behavioural hypothesis for homogamy rests on a number of assumptions: that a large male will win a fight against a smaller male; that the males are capable of recognizing the relative size of a female, and that there are no other factors affecting a females desirability, e.g. imminence of moult, and hence reduced guarding time.

We tested each of these assumptions in the laboratory using artificial conflicts between chosen individuals, taken from mating pairs on the shore.

Firstly, the largest male does not always win in a two male conflict. Out of 85 conflicts between two males over a single female, the smaller male won 36% of the time. Successful smaller males ranged from 2mm to 12mm smaller than their opponent. Similar results were found for groups of males with a restricted number of females (smaller crabs were successful 38% of the time).

In a second set of experiments, one male crab was offered a choice of two females, one large (50–58mm carapace width), the other small (38–43mm). In 57 trials the male chose the smaller female 49% of the time. Similar results were found for groups of males offered an excess of large and small females with 48% of the males mating with the smaller females.

We found that the males did not appear to choose a female according to the imminence of her moult. Field collections showed that there was a slight tendency for large males to be found paired with females further from their moult than small males. In the laboratory single males offered a choice between two females chose the female furthest from her moult approximately 50% of the time.

It would appear that large male *Carcinus* are incapable of discerning a relatively large female or one closer to her

moult, and may not win a fight to mate with her even if he did.

A second possible explanation for the observed homogamy in the field is mechanical constraints. We collected over 500 mating pairs of crabs and in no case was the female larger than the male, and usually at least 6mm smaller. During pre-copulatory guarding, the male carries the female under him. It may be difficult or impossible for him to move with a female which is larger than himself. After she has moulted and grown this problem will be exacerbated, which may explain why males tend to pair with females at least 6mm smaller. A second possible factor is that very large males (carapace width > 70mm) rarely mate with females more than 35mm smaller than themselves. This may be due to difficulty in either carrying, or in actually copulating.

We have developed a computer model using the population results found on the shore, in which each male is paired at random with any female within the bounds described. No pairing if the female is within 6mm carapace width of the male or if she is more than 35mm smaller than him. The resulting, simulated, population of mating pairs also shows a distinct positive relationship between male and female size, which is very similar to the field population.

It seems likely, therefore, that homogamy, in this species, is a result of mainly mechanical constraints, and not conflict between males over the 'best' females. This interpretation is supported by the field study. Over 50% of the mating females had moulted within two tidal cycles of capture, which may suggest that if the males were capable of exercising choice they would have very little time in which to do so. Furthermore, in this location there are less females than males, and only a fraction of those will be moulting, and hence available to mate, at any one time. Provided that the available females are sufficiently rare, in both time and space, it would seem likely that the best strategy for an individual male, having found or won a receptive female, would be to remain with her and to mate with her. There is clearly a trade-off between the increased reproductive success of mating with an optimally large female and the amount of time spent finding her. It would seem likely that male *Carcinus* would only adopt a strategy of picking and choosing females, if they were sufficiently common to justify this.

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